



(11) **EP 2 608 265 A3**

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
23.12.2015 Bulletin 2015/52

(51) Int Cl.:
H01L 29/739 ^(2006.01) **H01L 29/10** ^(2006.01)
H01L 29/02 ^(2006.01)

(43) Date of publication A2:
26.06.2013 Bulletin 2013/26

(21) Application number: **12198057.7**

(22) Date of filing: **19.12.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **22.12.2011 JP 2011282028**
13.12.2012 JP 2012272125

(71) Applicant: **NGK Insulators, Ltd.**
Nagoya-city, Aichi 467-8530 (JP)

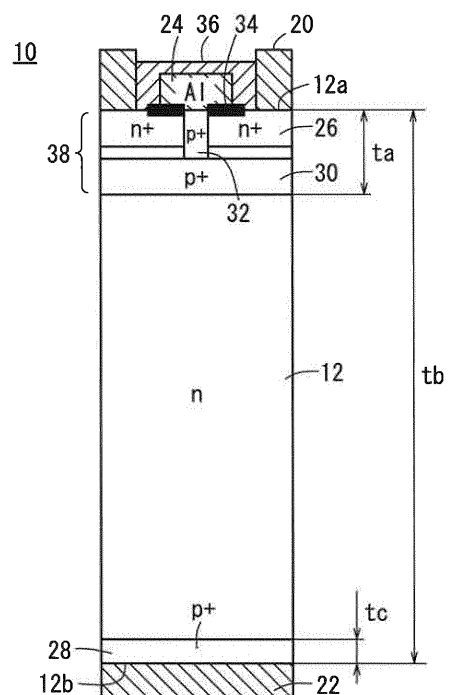
(72) Inventors:
• **Yokoi, Shoji**
Nagoya city Aichi 467-8530 (JP)
• **Shimizu, Naohiro**
Nagoya city Aichi 467-8530 (JP)
• **Kimura, Masakazu**
Hamamatsu-city Shizuoka 432-8561 (JP)

(74) Representative: **Naylor, Matthew John et al**
Mewburn Ellis LLP
City Tower
40 Basinghall Street
London EC2V 5DE (GB)

(54) **Semiconductor device having a gate electrode**

(57) A semiconductor device (10) contains a semiconductor substrate (12), a cathode (20), an anode (22), and a gate electrode (24). The semiconductor device (10) has a cathode segment (26) disposed in a portion corresponding to at least the cathode (20), an anode segment (28) disposed in a portion corresponding to the anode (22), a plurality of embedded segments (30) disposed in a portion closer to the cathode segment (26) than to the anode segment (28), a takeoff segment (32) disposed between the gate electrode (24) and the embedded segments (30) to electrically connect the gate electrode (24) to the embedded segments (30), and a channel segment (31) disposed between the adjacent embedded segments (30).

FIG. 3A





EUROPEAN SEARCH REPORT

Application Number
EP 12 19 8057

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 014 080 A1 (HITACHI LTD [JP]) 6 August 1980 (1980-08-06) * page 5, line 17 - page 8, line 25 * * figures 1,2 *	1-9	INV. H01L29/739 H01L29/10
X	EP 1 128 443 A1 (KANSAI ELECTRIC POWER CO [JP]) 29 August 2001 (2001-08-29) * paragraph [0031] - paragraph [0034] * * figure 6 *	1-9	ADD. H01L29/02
X	US 4 984 049 A (NISHIZAWA JUN-ICHI [JP] ET AL) 8 January 1991 (1991-01-08) * column 8, line 21 - line 56 * * figures 19a-19c *	1-9	
X	JP S54 152873 A (HITACHI LTD) 1 December 1979 (1979-12-01) * abstract; figures 1-3 *	1-9	
A	US 3 268 374 A (ANDERSON ROBERT E) 23 August 1966 (1966-08-23) * column 2, line 18 - column 3, line 13 * * figures 1-3 *	6,7	TECHNICAL FIELDS SEARCHED (IPC) H01L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 November 2015	Examiner Kostrzewa, Marek
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 19 8057

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-11-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0014080 A1	06-08-1980	DE 3065437 D1	08-12-1983
		EP 0014080 A1	06-08-1980
		JP S5596677 A	23-07-1980
		JP S6016753 B2	27-04-1985

EP 1128443 A1	29-08-2001	EP 1128443 A1	29-08-2001
		JP 4132011 B2	13-08-2008
		US 6600192 B1	29-07-2003
		WO 0022679 A1	20-04-2000

US 4984049 A	08-01-1991	EP 0064561 A1	17-11-1982
		JP H0126187 B2	22-05-1989
		JP S5788771 A	02-06-1982
		US 4984049 A	08-01-1991
		WO 8201788 A1	27-05-1982

JP S54152873 A	01-12-1979	JP S6046550 B2	16-10-1985
		JP S54152873 A	01-12-1979

US 3268374 A	23-08-1966	NONE	
